H120 Ventriculoperitoneal Shunt Occlusion Resulting in Acute Hydrocephalus and Death in Developmentally Delayed Patients: Two Case Reports

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Learning Overview: After attending this presentation, attendees will be familiar with the indications for and complications of Ventriculoperitoneal (VP) shunts.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by highlighting two cases of death related to acute hydrocephalus related to VP shunt occlusion occurring in chronically disabled patients with hydrocephalus.

The standard clinical strategy for managing conditions with chronic hydrocephalus involves the placement of a VP shunt. Although the successful function of VP shunts has improved since their initial implementation, VP shunt failure remains a persistent issue of concern, with approximately half of all VP shunt patients requiring replacement or revision of their shunt.[1,2] One common cause of shunt failure involves the physical obstruction of the device, either by biological tissue or organic material.[1] Although death related to obstruction of VP shunts is a recognized complication, the mortality rate related to VP shunt obstruction is poorly defined. This study describes two cases of death related to acute hydrocephalus resulting from obstruction of VP shunts.

Case 1: A 23-year-old female cerebral palsy patient, with additional history of congenital hydrocephalus, mental handicap, a VP shunt, and seizures, was admitted to a hospital for complaints of abdominal pain, nausea, and vomiting of three days duration. She received supportive care for a diagnosis of "gastroenteritis" and was discharged to home in a markedly improved condition. During hospitalization, she had no known neurologic complaints; however, three days after discharge, she was found unresponsive and apneic at her group home. Despite initial successful resuscitation, she was pronounced braindead shortly after admission. A limited, head-only, hospital autopsy was performed at the request of the legal next-of-kin.

Autopsy disclosed diffuse cerebral edema with associated cerebellar tonsillar and cerebral uncal herniation. Evaluation of the VP shunt revealed proximal occlusion by a soft, red-tan substance, which, on microscopic exam, was composed of fibrovascular tissue with chronic inflammatory cells. The cause of death was ruled as complications of hydrocephalus/cerebral palsy, with proximal occlusion of VP shunt.

Case 2: A 15-year-old cerebral palsy patient, with additional history of meningomyelocele, seizures, and hydrocephalus with VP shunt, presented to an Emergency Department (ED) with complaints of progressively worsening headache and neck pain. Upon arrival at the ED, he experienced a seizure and became unresponsive. He was resuscitated, and an emergent computerized tomography scan of the head showed increased size of the 3rd and lateral ventricles, compared to previous studies. Despite emergent decompression, he died the next day. An autopsy was performed at the request of the legal next-of-kin.

Autopsy revealed marked cerebral edema with associated cerebellar tonsillar herniation and hemorrhage, adjacent medullary hemorrhage, and dilated ventricles. The VP shunt had numerous areas of intraluminal precipitate and dilations along its course but was patent except for a complete obstruction just inferior to the valve and reservoir device, behind the patient's ear. The cause of death was ruled as acute obstructive hydrocephalus due to VP shunt obstruction related to underlying meningomyelocele and cerebral palsy.

Although VP shunt failure is relatively common, death related to such failure is relatively rare, or at least not well-described in the literature. A 2004 study of pediatric patients in five regional hospitals over a ten-year period reported only eight deaths related to shunt failure.[3] A search for similar studies in older patients could not be found. The presented cases serve to highlight the importance of shunt evaluation at autopsy in cases of sudden, unexpected death in this vulnerable patient population.

Reference(s):

1. Browd S.R., Ragel B.T., Gottfried O.N., Kestle J.R. Failure of Cerebrospinal Fluid Shunts: Part I: Obstruction and Mechanical Failure. *Pediatr Neurol*. 2006;34:83–92.
2. Reddy G.K., Bollam P., Caldito G. Long-Term Outcomes of Ventriculoperitoneal Shunt Surgery in Patients With Hydrocephalus. *World Neurosurg*. 2014;81;404–10.
3. Bryant M.J., McEniery J., Walker D.G., Campbell R., Lister B., Sargent P., Withers T.K., Baker J., Guazzo E., Rossato R., Anderson D., Tomlinson F. Preliminary Study of Shunt Related Death in Pediatric Patients. *J Clin Neurosci.* 2004;11:614–5.

Ventriculoperitoneal Shunt, Hydrocephalus, Death